2002

Effects of Management Practices on Grassland Birds: Dickcissel

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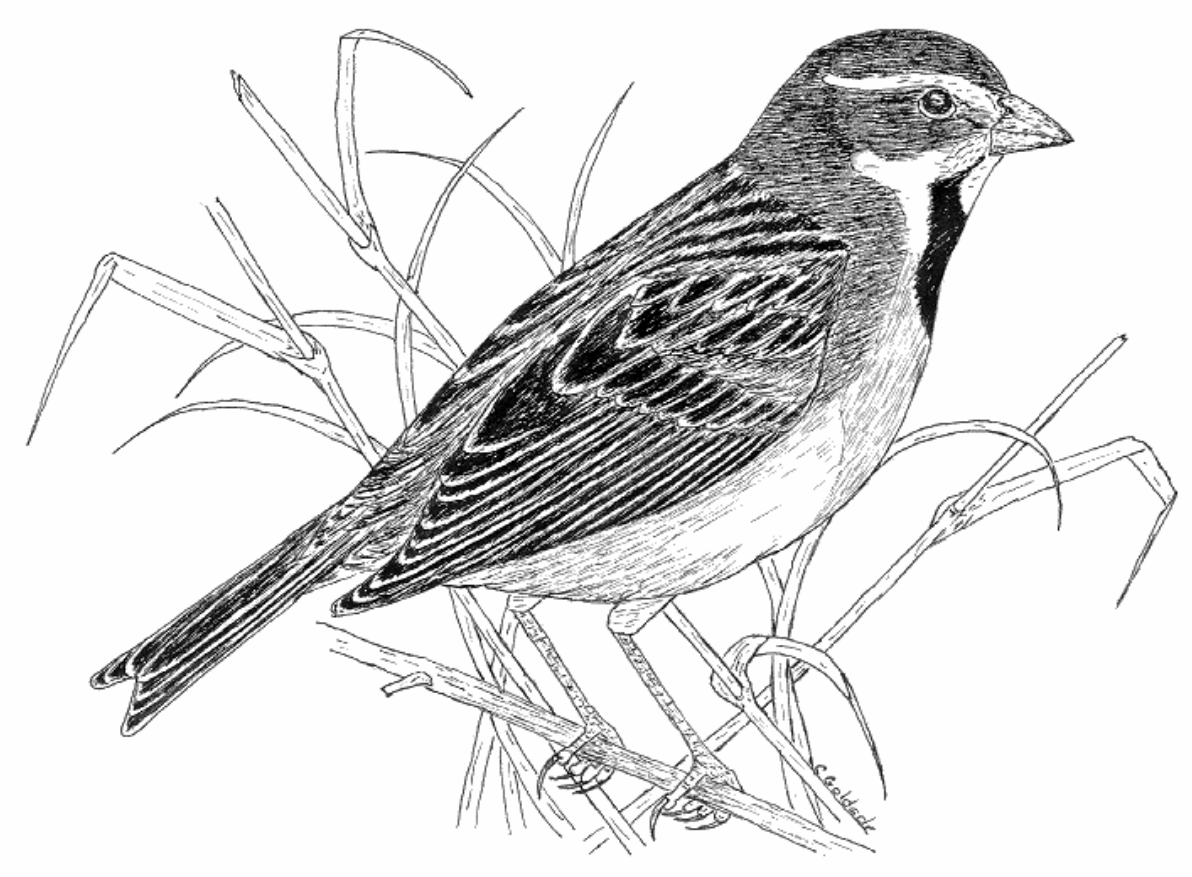
DICKCISSEL



Grasslands Ecosystem Initiative
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This report is one in a series of literature syntheses on North American grassland birds. The need for these reports was identified by the Prairie Pothole Joint Venture (PPJV), a part of the North American Waterfowl Management Plan. The PPJV recently adopted a new goal, to stabilize or increase populations of declining grassland- and wetland-associated wildlife species in the Prairie Pothole Region. To further that objective, it is essential to understand the habitat needs of birds other than waterfowl, and how management practices affect their habitats. The focus of these reports is on management of breeding habitat, particularly in the northern Great Plains.

Suggested citation:

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 1999 (revised 2002). Effects of management practices on grassland birds: Dickcissel. Northern Prairie Wildlife Research Center, Jamestown, ND. 32 pages.

Species for which syntheses are available or are in preparation:

American Bittern
Mountain Plover
Marbled Godwit
Long-billed Curlew
Willet
Wilson's Phalarope
Upland Sandpiper
Greater Prairie-Chicken
Lesser Prairie-Chicken
Northern Harrier
Swainson's Hawk
Ferruginous Hawk
Short-eared Owl
Burrowing Owl
Horned Lark
Sedge Wren
Loggerhead Shrike
Sprague's Pipit
Grasshopper Sparrow
Baird's Sparrow
Henslow's Sparrow
Le Conte's Sparrow
Nelson's Sharp-tailed Sparrow
Vesper Sparrow
Savannah Sparrow
Lark Sparrow
Field Sparrow
Clay-colored Sparrow
Chestnut-collared Longspur
McCown's Longspur
Dickcissel
Lark Bunting
Bobolink
Eastern Meadowlark
Western Meadowlark
Brown-headed Cowbird

EFFECTS OF MANAGEMENT PRACTICES ON GRASSLAND BIRDS:

DICKCISSEL

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Major Funding: Prairie Pothole Joint Venture, U.S. Fish and Wildlife Service
U.S. Geological Survey

Funding also provided by: U.S. Forest Service
The Nature Conservancy

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March 1999
(revised January 2002)

ORGANIZATION AND FEATURES OF THIS SPECIES ACCOUNT

Information on the habitat requirements and effects of habitat management on grassland birds were summarized from information in more than 4,000 published and unpublished papers. A ***range map*** is provided to indicate the relative densities of the species in North America, based on Breeding Bird Survey (BBS) data. Although birds frequently are observed outside the breeding range indicated, the maps are intended to show areas where managers might concentrate their attention. It may be ineffectual to manage habitat at a site for a species that rarely occurs in an area. The species account begins with a brief ***capsule statement***, which provides the fundamental components or keys to management for the species. A section on ***breeding range*** outlines the current breeding distribution of the species in North America, including areas that could not be mapped using BBS data. The ***suitable habitat*** section describes the breeding habitat and occasionally microhabitat characteristics of the species, especially those habitats that occur in the Great Plains. Details on habitat and microhabitat requirements often provide clues to how a species will respond to a particular management practice. A ***table*** near the end of the account complements the section on suitable habitat, and lists the specific habitat characteristics for the species by individual studies. A special section on ***prey habitat*** is included for those predatory species that have more specific prey requirements. The ***area requirements*** section provides details on territory and home range sizes, minimum area requirements, and the effects of patch size, edges, and other landscape and habitat features on abundance and productivity. It may be futile to manage a small block of suitable habitat for a species that has minimum area requirements that are larger than the area being managed. The Brown-headed Cowbird (*Molothrus ater*) is an obligate brood parasite of many grassland birds. The section on ***cowbird brood parasitism*** summarizes rates of cowbird parasitism, host responses to parasitism, and factors that influence parasitism, such as nest concealment and host density. The impact of management depends, in part, upon a species' nesting phenology and biology. The section on ***breeding-season phenology and site fidelity*** includes details on spring arrival and fall departure for migratory populations in the Great Plains, peak breeding periods, the tendency to renest after nest failure or success, and the propensity to return to a previous breeding site. The duration and timing of breeding varies among regions and years. ***Species' response to management*** summarizes the current knowledge and major findings in the literature on the effects of different management practices on the species. The section on ***management recommendations*** complements the previous section and summarizes specific recommendations for habitat management provided in the literature. If management recommendations differ in different portions of the species' breeding range, recommendations are given separately by region. The ***literature cited*** contains references to published and unpublished literature on the management effects and habitat requirements of the species. This section is not meant to be a complete bibliography; a searchable, annotated bibliography of published and unpublished papers dealing with habitat needs of grassland birds and their responses to habitat management is posted at the Web site mentioned below.

 Please direct comments and suggestions to Douglas H. Johnson, Northern Prairie Wildlife Research Center, U.S. Geological Survey, 8711 37th Street SE, Jamestown, North Dakota 58401; telephone: 701-253-5539; fax: 701-253-5553; e-mail: Douglas_H_Johnson@usgs.gov.

DICKCISSEL
(*Spiza americana*)

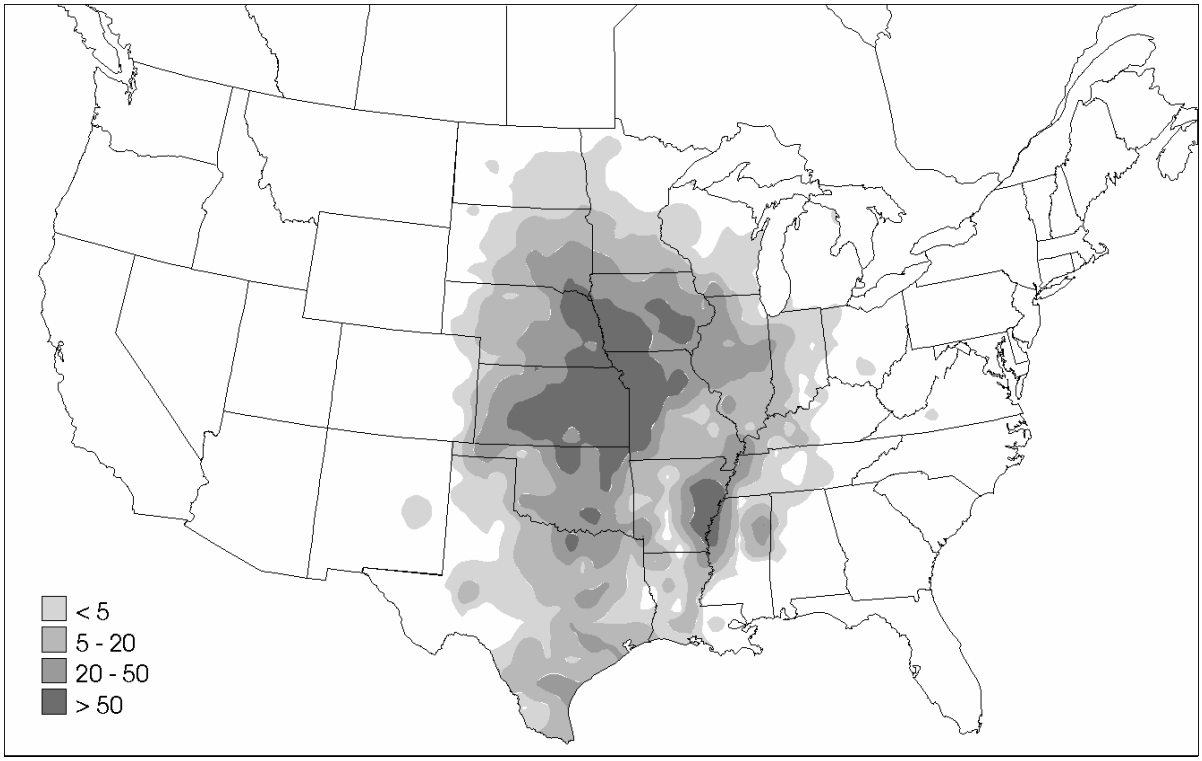

Figure. Breeding distribution of the Dickcissel in the United States and southern Canada, based on Breeding Bird Survey data, 1985-1991. Scale represents average number of individuals detected per route per year. Map from Price, J., S. Droege, and A. Price. 1995. The summer atlas of North American birds. Academic Press, London, England. 364 pages.

Keys to management include providing suitable habitat (dense, moderate to tall vegetation, particularly with some forbs, and moderately deep litter) and controlling succession.

Breeding range:

Dickcissels breed from northern North Dakota south through western South Dakota, eastern Colorado, and northeastern New Mexico to southern Texas and Louisiana, and east to northern Alabama, western Tennessee, western Kentucky, western Ohio, and southern Michigan and Wisconsin (National Geographic Society 1999). (See figure for the relative densities of Dickcissels in the United States and southern Canada, based on Breeding Bird Survey data.)

Suitable habitat:

Dickcissels prefer habitat with dense, moderate to tall vegetation (particularly with some forbs) and moderately deep litter (Gross 1921, 1968; Harmeson 1972, 1974; Wiens 1973; Harrison 1974; Petersen 1978; Rotenberry and Wiens 1980; Roth 1980; Finck 1983, 1984; Skinner et al. 1984; Kahl et al. 1985; Frawley 1989; Sample 1989; Delisle and Savidge 1997; Winter 1998). Suitable habitats are found in oldfields, hayfields, fencerows, hedgerows, road rights-of-way, planted cover (e.g., Conservation Reserve Program [CRP] fields and dense

nesting cover), and moderately grazed and idle prairie (Gross 1921, 1968; Taber 1947; Sauer 1953; Ely 1957; Hergenrader 1962; Graber and Graber 1963; Meanley 1963; Emlen and Wiens 1965; Blankespoor 1970; Berry 1971; Harmeson 1972, 1974; Harrison 1974; Stewart 1975; Sealy 1976; Petersen 1978; Rotenberry and Wiens 1980; Roth 1980; Faanes 1981; Finck 1983, 1984; Renken 1983; Skinner et al. 1984; Kahl et al. 1985; Basore et al. 1986; Sample 1989; Camp and Best 1993; Johnson and Schwartz 1993; Steigman 1993; Faanes and Lingle 1995; Johnson and Igl 1995; King and Savidge 1995; Hull et al. 1996; Best et al. 1997; Delisle and Savidge 1997; Winter 1998; Hughes et al. 1999; Jensen 1999). A high abundance of forbs provides perches, nesting cover, nest support, and possibly increased invertebrate abundance (Blankespoor 1970; Zimmerman 1971; Harmeson 1972, 1974; Birkenholz 1973; Skinner et al. 1984; Frawley and Best 1991; Klute 1994; Patterson 1994; Patterson and Best 1996; Winter 1998). In southwestern Missouri, Skinner et al. (1984) found Dickcissels in medium to tall grasslands with many tall forbs, conditions that were found in moderately grazed to idle cover. Skinner (1974, 1975) reported that Dickcissel densities in northwestern Missouri were highest with moderate amounts of forbs, and were lower when forbs were either very scarce or very abundant. In southwestern Missouri tallgrasss prairie fragments, Dickcissel density increased with vegetation height (Winter 1998). In Kansas, Dickcissel densities were higher in oldfields compared with prairie (Petersen 1978; Finck 1983, 1984). Fence posts, small trees, and tall forbs are commonly used as song perches (Laubach 1984, Kahl et al. 1985).

Nests are elevated in grasses, forbs, shrubs, or trees, and less commonly on the ground in thick vegetation (Gross 1921; Overmire 1962, 1963; Meanley 1963; Zimmerman 1966; Blankespoor 1970; Fretwell 1977; Frawley 1989; Winter 1999). Nest heights range from 0 to 2 m (Taber 1947, Ely 1957, Meanley 1963, Von Steen 1965, Gross 1968, Berry 1971, Roth 1980, Laubach 1984, Winter 1998). In Kansas, the majority of nests in oldfields, tallgrass prairie, waterways, and stubble fields were in forbs (Zimmerman 1966, Blankespoor 1970), followed by isolated American elm (*Ulmus americana*) saplings, thistle (*Cirsium* sp.), and grass (Blankespoor 1970). In tallgrass pasture in Kansas, most Dickcissel nests were adjacent to patches of dogwood (*Cornus*) (Fleischer 1986). In CRP fields with sparse forb coverage, nests were in solitary clumps of bunchgrasses surrounded by litter (Hughes et al. 1999). Hughes (1996) found that vegetation at nests was characterized by higher overall vegetative volume in the canopy and lower amounts of bare ground and litter coverage than either the area immediately adjacent to the nest (within 4 m) or the field in which the nest was located. In Oklahoma, Dickcissels nested on the ground and in greenbrier (*Smilax bona-nox*) thickets within oldfields; nest heights in an oldfield ranged from 3 to 60 cm (Ely 1957, Berry 1971). Ground nests were more successful than elevated nests in Oklahoma; as the season progressed, however, nests were built higher above the ground (Overmire 1963). In Nebraska, nests averaged 34 cm high in alfalfa (*Medicago sativa*) and rose (*Rosa* sp.) (Von Steen 1965). In an Illinois oldfield, Dickcissels nested in live forbs and dead vegetation; most nests were in wild aster (*Aster pilosus*), but nests in dead vegetation were more productive (Harmeson 1972, 1974). Nests in trees or hedges in Illinois were 0.6-1.8 m high (Gross 1968). In Missouri, most nests were found in individual forb plants; nests were occasionally placed above the ground in clumps of grass or in shrubs, or on the ground in litter (Sauer 1953, Skinner et al. 1984, Winter 1999). Winter (1999) reported that successful nests were placed in areas with significantly taller vegetation, greater visual obstruction, greater grass cover, and less bare ground cover than unsuccessful nests. Dickcissels in Iowa placed nests in forbs, grasses, shrubs, and deciduous tree saplings

(Best et al. 1981). Nests in Texas were associated with woody plants and were surrounded by dense grass or forbs (Roth 1980). Within tallgrass prairie in Texas, nests were located most often in green milkweed (*Asclepias viridiflora*), sensitive briar (*Schrankia roemeriana*), and eastern gammagrass (*Tripsacum dactyloides*) (Steigman 1993). Hayland is used more frequently for nesting than cropland (Gross 1968, Faanes and Lingle 1995). In Nebraska, hayland was commonly used for nesting, with fewer nests found in wet prairie, wetland, upland prairie, lowland forest, or cropland (Von Steen 1965, Faanes and Lingle 1995). Ducey and Miller (1980) found that Dickcissels nested unsuccessfully in alfalfa (nest loss was caused by mowing) and oat fields (unknown cause of nest loss) in Nebraska. In Illinois, hayland was preferred for nesting, whereas no nests were found in pasture or cropland (Gross 1968). Dickcissels in Wisconsin also commonly nested in hayfields (Taber 1947).

Dickcissels occasionally nest in strip cover such as roadside ditches, fencerows, and grassed waterways (Gross 1921; Meanley 1963; Basore et al. 1986; Bryan and Best 1991, 1994; Camp and Best 1994; Warner 1994). In Illinois, Dickcissels nested in wider tracts of strip cover, such as waterways (7-28 m wide) as opposed to fencerows (1-3 m wide) (Warner 1994). Nests were found in grassed waterways in Iowa (Bryan and Best 1991, 1994) and road rights-of-way in Nebraska (Hergenrader 1962) that were planted to smooth brome (*Bromus inermis*). In Iowa, Dickcissels preferred nesting in strip cover over tilled or untilled (idle in fall and spring and containing year-round crop residue) cropland (Basore et al. 1986). The probability of occurrence of Dickcissels was significantly greater in Iowa grassed waterways that had greater forb cover than those with lesser forb cover (Bryan and Best 1994). In Arkansas, Dickcissel densities were higher in brushy roadside borders than in open fields (Meanley 1963). Nests in road rights-of-way or other edge habitats, however, can experience high rates of depredation (Basore et al. 1986, Camp and Best 1994).

In portions of Colorado, Kansas, Montana, Nebraska, Oklahoma, South Dakota, Texas, Wisconsin, and Wyoming, Dickcissel abundance was related positively to percent grass cover, percent litter cover, vegetation density, vegetation height, and litter depth (Rotenberry and Wiens 1980). In Iowa, Dickcissel abundance was related negatively to tree species richness, density, and size, as well as sapling density and the horizontal patchiness of trees (Best et al. 1981). In Nebraska, Dickcissel abundance was related positively to litter depth, vertical density, and percent forb cover (Delisle and Savidge 1997). In a Michigan alfalfa field, Dickcissels occupied areas of low plant diversity; low vegetation density at a height of 5 cm; and high litter cover, vegetation height, and vertical density of vegetation (Harrison 1974). A table near the end of the account lists the specific habitat characteristics for Dickcissels by study.

Area requirements:

Mean territory size in tallgrass prairie in Kansas ranged from 0.40 to 0.57 ha, whereas the mean territory size in oldfields ranged from 0.15 to 0.95 ha (Zimmerman 1966; Schartz 1969; Petersen 1978; Finck 1983, 1984). The mean territory size of Dickcissels in an Illinois oldfield ranged from 0.38 to 0.54 ha (Harmeson 1972, 1974). The mean territory sizes in ungrazed and grazed tallgrass prairie in Oklahoma were 0.25 ha and 0.47 ha, respectively (Overmire 1963). Larger territory sizes of 1.4 ha and 1.5 ha were reported for tallgrass prairie in Iowa and tallgrass pasture in Oklahoma, respectively (Wiens 1971, Laubach 1984).

Although information is inconclusive, Dickcissels appear to be relatively tolerant of habitat fragmentation on a distributional level (Herkert 1991*a*,*b*; Herkert et al. 1993; Winter

1998). In Illinois, Dickcissel abundance in burned tallgrass prairie fragments was related inversely to area (Herkert 1994*a*). Conversely, in idle tallgrass prairie fragments in Illinois, no relationship between Dickcissel abundance and fragment size was found (Herkert 1991*a*, 1994*b*); the minimum area in which Dickcissels were found was <10 ha (Herkert 1991*a*,*b*). In Nebraska, the minimum area in which Dickcissels were found was 9 ha, with a perimeter-area ratio of about 0.020 (Helzer 1996, Helzer and Jelinski 1999). Occurrence of Dickcissels was positively correlated with patch area and inversely correlated with perimeter-area ratio (Helzer and Jelinski 1999). Dickcissel abundance in Missouri was related positively with prairie size (Swengel 1996). In another Missouri study, distribution and density of Dickcissels was not influenced by fragment size, but fragment size did appear to affect productivity (Winter 1996, 1999; Winter and Faaborg 1999). Dickcissel nests had a 9% probability of survival in small fragments and a 31% probability of survival in large fragments (Winter 1996). Nest depredation was higher <50 m from an edge habitat than >50 m from an edge (Winter et al. 2000). Dickcissel density increased with decreasing distance among grassland patches (Winter 1998). Hughes (1996) found that nest success in Kansas was not significantly different between nests located <50 m from a wooded edge than nests located >50 m from a wooded edge.

In Illinois, Dickcissel nests located within 50 m of woody edges or other tall (>2 m), woody vegetation were more than twice as likely to be parasitized as nests >50 m from woody vegetation (J. R. Herkert, Illinois Endangered Species Protection Board, Springfield, Illinois and S. K. Robinson, Illinois Natural History Survey, Champaign, Illinois, *unpublished data*). In southwestern Missouri, the frequency of Brown-headed Cowbird (*Molothrus ater*) brood parasitism increased significantly with proximity to shrubby edges; frequency of brood parasitism was highest <50 m from a shrubby edge (Winter 1998, Winter et al. 2000). In Kansas, brood parasitism rates were significantly higher for nests placed ≤100 m from woodland edges compared to nests placed >100 m from woodland edges (W. E. Jensen, Kansas State University, Manhattan, Kansas, pers. comm.). However, parasitism rates were not different for nests placed ≤100 m from agricultural edges versus nests placed >100 m from agricultural edges (Jensen 1999). In Missouri tallgrass prairie fragments, the rate of Brown-headed Cowbird brood parasitism was not related to fragment size (Winter 1998, Winter et al. 2000).

Brown-headed Cowbird brood parasitism:

Rates of brood parasitism by the Brown-headed Cowbird vary from 0% of 29 nests (Robinson et al. 2000) to 95% of 19 nests (Elliott 1978). Refer to Table 1 in Shaffer et al. (2003) for rates of cowbird brood parasitism. Dickcissels may be multiply-parasitized (Smith 1882, Friedmann 1963, Zimmerman 1966, Schartz 1969, Elliott 1978, Winter 1999) and have been known to abandon parasitized nests (Zimmerman 1966, Elliott 1978). Parasitism can lower Dickcissel productivity (Overmire 1963; Wiens 1963; Zimmerman 1982, 1983; Schartz 1969; Elliott 1976; Fretwell 1977; Winter 1998).

When comparing brood parasitism rates in the central Great Plains, Basili (1997) found significantly higher brood parasitism rates in Kansas and Nebraska and significantly lower rates in Texas. This variation in the rate of brood parasitism was related to the variation in cowbird density in different areas of the central Great Plains (Basili 1997). Brood parasitism by Brown-headed Cowbirds can be nest density dependent; areas with low nesting densities of Dickcissels, such as tallgrass prairies, can experience higher intensities and frequencies of Brown-headed Cowbird parasitism than areas with high nesting densities, such as oldfields (Fretwell 1977;

Zimmerman 1982, 1983). However, Fleischer (1986) found that rates of brood parasitism in Kansas were not related to Dickcissel nest density, but were related to nest height. Parasitized nests were placed significantly higher (mean of 0.65 m) above the ground than unparasitized nests (mean of 0.34 m). In Missouri, there were no significant differences in vegetation measurements between parasitized and unparasitized nests (Winter 1999). However, clutch size and the number of young fledged from successful nests were significantly lower for parasitized nests. Fretwell (1972) observed that higher rates of brood parasitism occurred in Dickcissel nests when they were placed near Red-winged Blackbird (*Agelaius phoeniceus*) nests.

Breeding-season phenology and site fidelity:

Dickcissels arrive on the breeding grounds in the central and northern Great Plains from late April to late May and depart for the wintering grounds from late August to mid-September (Gross 1921, 1968; Taber 1947; Sauer 1953; Schartz 1969; Johnsgard 1980; Faanes 1981; Finck 1983, 1984; Laubach 1984; Winter 1999). Dickcissels in Texas, Oklahoma, and Arkansas arrive on the breeding grounds from mid-April to early May and depart from late July to mid-September (Meanley 1963, Overmire 1963, Fretwell 1972, Roth 1980). Peak nest initiation in southwestern Missouri occurred in early June (Winter 1999). Renesting is common (Harmeson 1972, 1974; Zimmerman 1982; Winter 1998). Double-brooding may occur in some areas (Harmeson 1972), however, results from a study conducted in southwestern Missouri suggested that only a single brood is produced per breeding season (Winter 1998).

Information from banding studies in Kansas has shown that Dickcissels exhibit site fidelity (Schartz 1969, Zimmerman and Finck 1989). Zimmerman and Finck (1989) reported an average return rate of 49% for 82 male Dickcissels followed for 5 yr, but found no evidence of female site fidelity. Klimkiewicz and Futcher (1987) reported that a banded male returned to the same general area in which he was banded. Schartz (1969) demonstrated site fidelity in both males and females. Return rates for males ranged from a low of 26% of 23 birds to a high of 58% of 12 birds over three years. Only 4% of 26 females returned.

Species' response to management:

Burning (Zimmerman 1992, Hughes 1996), mowing (Swengel 1996), or grazing (Klute 1994, Klute et al. 1997) can provide suitable Dickcissel habitat by controlling succession. Regardless of management treatment, avoid disturbing habitat during the breeding season, which ranges from late April to late August (Gross 1921, 1968; Stewart 1975; Finck 1984). Treatments can occur in early spring (several weeks prior to their arrival on the breeding grounds) or possibly in the fall after the breeding season (Hughes 1996). Bollinger et al. (1990) suggested maintaining adjacent, untreated areas to provide refuge for fledglings and late-nesting or renesting Bobolinks (*Dolichonyx oryzivorus*), a technique that also could be applied for Dickcissels.

Petersen (1978) reported that Dickcissels were present in both annually burned and unburned tallgrass prairie in Kansas. Densities and territory size were not significantly different between burned and unburned prairie, but densities were significantly higher and territory size significantly smaller in oldfields than densities and territory size in either the burned or unburned prairie. Dickcissels on burned prairie occupied "bottom" habitats, that is, areas that were parts of natural drainage systems and that contained tall, dense growths of forbs. Short vegetation on the upland burned prairie was not used. In unburned prairie, bottom habitats also were used.

However, in contrast to burned prairie, upland habitats were occupied. Vegetation on the upland, unburned prairie was taller and denser than that on the upland, burned prairie. Also in Kansas, spring burning had no effect on Dickcissel relative abundance except in drought years, when it had a negative effect (Zimmerman 1992). Dickcissel abundance was not related to the number of years since the last burning or haying treatment in Kansas (Zimmerman 1993) or Missouri (Swengel 1996, Winter 1998). In a Kansas study of spring-burned and unburned native CRP fields, abundance and nest success of Dickcissels were significantly higher on unburned than spring-burned CRP (Robel et al. 1998). Nesting success was significantly higher 1 yr and 3-4 yr postburn than 2 yr postburn. In Missouri, hayed areas had higher numbers of Dickcissels than spring-burned areas or areas that were both hayed and burned (Swengel 1996). Dickcissels in Illinois tallgrass prairie fragments were present one (1-4 mo) and two (13-16 mo) growing seasons postburn (Herkert 1994*b*). In Illinois, Westemeier and Buhnerkempe (1983) found that Dickcissels preferred tallgrass areas 3 yr postburn. Burning can be used to control woody plant invasion (Eddleman 1974).

Haylands with abundant forbs, especially legumes, attract high nesting densities of Dickcissels (Ryan 1986, Frawley 1989, Frawley and Best 1991). Mowing can be used to prevent encroachment of woody vegetation; however, annual mowing and mowing during the breeding season results in very high rates of nest failure for Dickcissels (Taber 1947, Ryan 1986, Frawley 1989, Frawley and Best 1991, Igl 1991). Low productivity and low annual return rates in mowed alfalfa fields suggest that these areas are population sinks (Sealy 1976, Igl 1991). In Michigan, Dickcissel breeding activities in hayfields were terminated following mowing (Monroe 1967, Harrison 1974, Harrison and Brewer 1979). In Iowa alfalfa fields, Dickcissels colonized fields after the first mowing during the breeding season, but only after vegetation height was >20 cm and forb coverage reached about 60% (Frawley 1989). Densities never recovered to pre-mowing levels. Igl (1991), however, noted that some alfalfa fields remained undisturbed after mowing for longer periods because of differences in landowners' mowing schedules; consequently, Dickcissel densities in these fields continued to increase and occasionally exceeded pre-mowing levels. In Missouri tallgrass prairie, Dickcissels were more common in conservation-hayed areas (mowed in July) than burned areas (Swengel 1996). In Missouri tallgrass prairie fragments, Dickcissel density increased with the number of years since the last haying treatment (Winter 1998). In Illinois tallgrass prairie, Dickcissels preferred areas that were hayed in mid-July every 2-3 yr over idle areas (Westemeier and Buhnerkempe 1983). Dickcissels nested in tallgrass prairie hay meadows in eastern Kansas (Jensen 1999).

Dickcissels used grazed tallgrass areas in Oklahoma (Overmire 1963, Wiens 1973). In Missouri, Dickcissels nested in moderately grazed to idle cover (Skinner et al. 1984). Bock et al. (1993) reported that Dickcissels responded positively to moderate grazing but negatively to heavy grazing in shortgrass prairie. Breeding densities of Dickcissels were low in grazed areas in Oklahoma and Illinois, possibly due to direct disturbance by cattle (Gross 1921, Overmire 1963). Eddleman (1974) advocated protection of suitable habitat from grazing in Kansas, where dense cover for nesting is required by the species. Grazing in combination with other management treatments can be particularly detrimental to Dickcissel abundance. In Kansas and Missouri, Dickcissels had lower abundance on areas both grazed and hayed than on hayed areas or areas both burned and hayed (Eddleman 1974, Swengel 1996). Combined grazing and burning of Kansas prairie resulted in fewer Dickcissels, lower productivity, and delayed nesting (Eddleman 1974, Zimmerman 1997). In Oklahoma, number of nests, clutch size, and average

number of young fledged from successful nests did not differ significantly between idle tallgrass plots and plots that were burned and/or grazed (Rohrbaugh et al. 1999). However, nest success was significantly lower on disturbed plots during incubation, brood-rearing, and combined phases of the nesting cycle. In southwestern Wisconsin, Dickcissels were more abundant in ungrazed grasslands than in continuously or rotationally grazed pastures (Temple et al. 1999). Ungrazed grasslands were neither mowed or grazed from 15 May to 1 July. Continuously grazed sites were grazed throughout the summer at levels of 2.5- 4 animals/ha. Rotationally grazed pastures, stocked with 40-60 animals/ha, were grazed for 1-2 d and then left undisturbed for 10-15 d before being grazed again; pastures averaged 5 ha. All sites were composed of 50-75% cool-season grasses, 7-27% legumes, and 8-23% forbs.

CRP grasslands provide important breeding habitat for Dickcissels in Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota (Johnson and Schwartz 1993, Patterson 1994, Johnson and Igl 1995, King and Savidge 1995, Hughes 1996, Hull et al. 1996, Klute 1996, Patterson and Best 1996, Best et al. 1997, Delisle and Savidge 1997, Klute et al. 1997, Hughes et al. 1999). However, McCoy et al. (1999) indicated that fecundity over 3 yr in Missouri CRP fields was significantly lower than necessary to support a stable population. A study in Kansas CRP fields by Hughes et al. (1999) investigated the effects of vegetative structure, composition of field edges, and land use within 800 m of CRP fields on the reproductive success and abundance of Dickcissels. Surrounding land use and characteristics of field edge (e.g., height, width, edge:area ratio) did not affect daily nest-survival rates. Daily nest-survival rate was positively associated only with percent litter cover within CRP fields and was negatively associated with both percent live and dead canopy cover. Abundance was positively associated with vertical density and negatively associated with amount of wooded area within 800 m of CRP fields and the percent wooded field perimeter around CRP fields. However, the authors caution that the results of wooded area and wooded perimeter may be an artifact of their sampling technique; they did not record Dickcissels using habitats at the edges of their study fields. Also in Kansas, Dickcissels were common in CRP fields planted to native grasses, with highest abundances occurring in fields with a high frequency of occurrence ($\geq$60%) of forbs (Hull et al. 1996). Klute (1994) recommended grazing of CRP grasslands in Kansas to increase forb abundance, thereby improving habitat for Dickcissels. In Nebraska, Dickcissels preferred unburned and unmowed CRP fields, and fields that were characterized by tall, native grasses with few forbs, deep litter, and residual vegetation (Delisle and Savidge 1997). Structurally complex vegetation preferred by Dickcissels was found in CRP fields planted to big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*) (Delisle and Savidge 1997). Dickcissels also were found in structurally complex cool-season grasslands of moderately dense brome, with patches of weedy, tall vegetation. In cool-season grasses, where overall vegetation density was low, Dickcissels used areas with dense forbs. In cool-season grasses without tall forbs, Dickcissels were absent or uncommon. Blankespoor (1980) found that Dickcissels in South Dakota used a restored grassland 2-4 yr after it was reseeded to native grasses. In North Dakota, Dickcissels were found in dense nesting cover planted to alfalfa/wheatgrass (*Agropyron* spp.) (Renken and Dinsmore 1987).

Low densities of Dickcissels sometimes are found in cropland areas that are untilled or under reduced tillage. Dickcissels nested in low densities in rowcrop fields (corn or soybeans)

that were either untilled or under reduced tillage in Iowa (Basore et al. 1986, Bryan and Best 1991).

In wheat fields treated with a mixture of toxaphene and methyl parathion in southeastern Missouri, Dickcissels showed high levels of cholinesterase inhibition activity in their brains, however, no dead or abnormally behaving birds were observed (Niethammer and Baskett 1983).

Management Recommendations:

Protect areas ($\geq$10 ha for Illinois grassland) of suitable habitat (Herkert 1991*a*,*b*). In Missouri, Dickcissel abundance (Swengel 1996) and productivity (Winter 1996, 1998) increased with increasing prairie size. Shape, as well as area, of management units must be taken into consideration; perimeter-area ratio strongly influenced occurrence of Dickcissels in Nebraska (Helzer and Jelinski 1999).

Minimize disturbance to suitable habitat during the breeding season (Herkert 1994*a*).

Adjust timing and type of management according to habitat. For example, xeric and mesic prairies may differ in rates of postburn litter accumulation, such that xeric prairies should be burned less frequently (Swengel 1996).

In Kansas CRP fields, allow litter cover to accumulate by burning CRP fields less frequently (i.e., every 3 yr) (Hughes 1996, Hughes et al. 1999). Litter cover was positively associated with daily nest-survival rate. However, periodic burning in spring may be desirable to rejuvenate growth of warm-season grasses (Hughes 1996). Prescribed burning in summer or fall or light disking of selected portions of individual fields can maintain mid-successional seral stages and increase coverage of tall forbs.

To increase Dickcissel abundance and productivity, avoid conducting grazing and burning or grazing and haying treatments on the same site (Eddleman 1974, Swengel 1996, Zimmerman 1997). Simultaneous burning and grazing may simulate drought conditions, reducing above-ground herbaceous vegetation and decreasing nest-site availability (Zimmerman 1997).

On privately owned rangelands, work to create a mosaic of sites that are suitable for Dickcissel productivity as well as sites that will benefit cattle production (Zimmerman 1997). Burned and grazed sites benefit cattle production, whereas sites that are idle, only burned, or only moderately grazed provide dense herbaceous vegetation preferred by Dickcissels.

To enhance the use of grassy edges by Dickcissels, establish grassy filter strips along fields and existing edges and locate hay or small grains near wide grassland corridors (Warner 1994). Create large, grassy areas near small prairie fragments; small prairie fragments can support higher densities of Dickcissels if surrounded by other grassland habitat (Winter 1998).

Burn or mow grasslands and roadsides in blocks on a 3-5 yr rotational basis to maintain vegetation quality (Westemeier and Buhnerkempe 1983, Camp and Best 1993). Use prescribed

burning in a rotational system to provide a mosaic of habitats (Winter 1998, Rohrbaugh et al. 1999). Burn no more than 20-30% of a prairie fragment annually (Winter 1998). Burning is preferred to haying, because vegetation recovers more quickly after burning than haying (Winter 1998).

Delay mowing until after the peak nesting period (i.e., until after mid-August), when possible, to improve Dickcissel productivity (Gross 1921, 1968; Harrison 1974; Harrison and Brewer 1979; Bryan and Best 1991; Herkert 1994*a*; Zimmerman 1997). However, do not mow later than mid-September in northern regions, because vegetation will not have time to recover before the winter or the following spring (Bryan and Best 1991). Avoid mowing or eliminating forbs, brush, and hedgerows (Overmire 1963).

To maintain plant vigor in tallgrass prairie, do not graze warm-season grasses to <25 cm during the growing season (Skinner 1975).

Klute (1994) suggested allowing CRP grasslands to be grazed in Kansas to encourage forb growth.

Provide areas of tall, dense planted cover, such as that provided in CRP fields or dense nesting cover (Renken and Dinsmore 1987). Allow retired agricultural fields to undergo secondary succession (Klute 1994). However, when succession begins to advance to the point of becoming unsuitable for breeding Dickcissels, implement burning and/or grazing to control the growth of woody vegetation (Eddleman 1974).

Table. Dickcissel habitat characteristics.

Author(s)	Location(s)	Habitat(s) Studied*	Species-specific Habitat Characteristics
Basore et al. 1986	Iowa	Cropland, idle	Preferred to nest in strip cover (fencerows, roadside ditches, terraces, and waterways) rather than tilled fields or untilled fields (idled in fall and spring and which contained year-round crop residue); nested in low densities in corn planted into sod residue
Berry 1971	Oklahoma	Idle, tallgrass pasture	Nest heights in an oldfield ranged from 3 to 60 cm; one nested on the grazed site and five on the idle site
Best et al. 1981	Iowa	Idle, woodland, woodland edge	Nested (in order of decreasing percent occurrence) in forbs (44%), grass (33%), shrubs (11%), and deciduous saplings (11%); highest observations occurred in wooded edge and herbaceous habitats. Density was related significantly and negatively to tree species richness, density, and size; sapling density; and the horizontal patchiness of trees
Best et al. 1997	Indiana, Iowa, Kansas, Michigan, Missouri, Nebraska	Conservation Reserve Program (CRP; burned seeded-native, burned seeded-native/tame, burned tame, idle seeded-native, idle seeded-native/tame, idle tame, seeded-native/tame hayland, tame hayland), cropland	Was the most abundant species in CRP in Kansas and Nebraska; nested frequently in CRP; observed in reduced-tillage cropland, but no nests were found
Birkenholz 1973	Illinois	Idle, idle tallgrass, idle tame, wetland, wet	Were found in idle areas with forbs; avoided native prairie grassland and areas with bluegrass (*Poa* sp.)

		meadow	
Blankespoor 1970	Kansas	Cropland, idle mixed-grass/tame, idle tame	Nested mostly in forbs, followed by isolated American elm (*Ulmus americanus*) saplings or thistles (*Cirsium* sp.) and grass vegetation; most nests were found in waterways that had thick stands of smooth brome (*Bromus inermis*)
Blankespoor 1980	South Dakota	Idle seeded-native, seeded-native pasture	Were found in restored grassland 2-4 yr after reseeding to native prairie grasses
Bryan and Best 1991	Iowa	Cropland, idle tame, tame hayland	Nested in grassed waterways of smooth brome; were common in reduced-tillage fields of corn and soybeans
Bryan and Best 1994	Iowa	Cropland, idle tame, tame hayland	Nesting was 3.9 times more likely in grassed waterways with greater forb coverage than lesser forb coverage; nested in forbs
Camp and Best 1993, 1994	Iowa	Burned seeded-native tallgrass/tame, burned tame, cropland, idle seeded-native tallgrass/tame, idle tame	Were common along roadsides; were more abundant in roadsides with tame vegetation than roadsides composed of a mixture of native and tame vegetation, even though forb cover was low
Delisle and Savidge 1997	Nebraska	CRP (burned seeded-native, idle seeded-native, idle tame, seeded-native hayland, tame hayland)	Were found in CRP planted to native grasses (big bluestem [*Andropogon gerardii*], switchgrass [*Panicum virgatum*], and Indiangrass [*Sorghastrum nutans*]) and cool-season grasses (brome [*Bromus*]); preferred structurally complex vegetation, such as fields characterized by tall, native grasses with few forbs that had not been burned or mowed since being planted and that had deep litter and residual vegetation; used areas containing dense forbs in cool-season grasses with low overall vegetation density; were absent or present in low

			numbers in cool-season grasses without tall forbs; abundance in native and cool-season CRP was correlated positively to litter depth, vertical density, and percent forb cover
Ducey and Miller 1980	Nebraska	Cropland, idle, mixed-grass pasture, tame hayland	Nested in alfalfa (*Medicago sativa*), oats, and winter wheat
Eddleman 1974	Kansas	Burned tallgrass, burned tallgrass pasture, idle tallgrass, tallgrass pasture, wet meadow	Were present in all areas except heavily grazed/annually burned tallgrass; required dense cover for nesting; most commonly nested in lead plant (*Amorpha canescens*) and buckbrush (*Symphoricarpos orbiculatus*)
Ely 1957	Oklahoma	Idle, tame pasture, woodland	Nested on the ground and in greenbrier (*Smilax bona-nox*) thickets within oldfields; nest heights averaged 0-2 m
Emlen and Wiens 1965	Wisconsin	Cropland, idle, pasture, tame hayland, woodland	Were found in hayfields, oats, corn, and pasture; highest number of observations occurred in alfalfa, red clover (*Trifolium pratense*), peas, and other forbs, followed by tall grasses and small grains, corn, and pasture; were absent from wooded areas and brushland
Faanes 1981	Minnesota, Wisconsin	Cropland, idle, idle tallgrass/tame, shrub carr, tame hayland, tame pasture, wetland, wet meadow, woodland	Were found in oldfields and alfalfa fields
Faanes and Lingle 1995	Nebraska	Cropland, idle mixed-grass, idle shortgrass, idle tallgrass, pasture, tame	Commonly nested in alfalfa, wet prairie, wetland, and upland prairie; less commonly nested in lowland forest, corn, river channel island, and wheat

		hayland, wetland, wet meadow, woodland	
Finck 1983, 1984	Kansas	Idle, idle tallgrass	Higher densities were found in oldfields compared with prairie; males in oldfields attracted more mates
Fleischer 1986	Kansas	Tallgrass pasture	Nested adjacent to patches of dogwood (*Cornus*)
Frawley 1989, Frawley and Best 1991	Iowa	Tame hayland	Were found in mowed fields only after vegetation recovered to >20 cm in height and about 60% forb coverage
Graber and Graber 1963	Illinois	Cropland, hayland, idle, idle grassland, tame pasture, wetland, woodland	Highest abundances were found in hayland, followed by small-grain and grassland areas, shrubs, and hedgerows
Gross 1921	Illinois	Cropland, idle, tame hayland, tame pasture	Nested in hayland with dense forbs such as clover (*Trifolium*) and alfalfa; also were found, in order of decreasing density, in waste and fallow land, small grains, pasture, and corn; avoided farm yards and plowed or stubble fields
Gross 1968	Illinois	Cropland, hayland, idle, pasture	Nested in thick, short vegetation, including hayland, meadow grasses, and forbs; nested less commonly in shrubs and trees; highest densities were found in hayland meadows, lower densities were found in pasture and cropland
Harmeson 1972, 1974	Illinois	Idle	Most nested in live forbs, especially wild aster (*Aster pilosus*); those that nested in dead vegetation were more productive than those that nested in wild aster
Harrison 1974,	Michigan	Tame hayland	Occupied areas of low plant diversity (12 plant species),

Harrison and Brewer 1979			low vegetation density at a height of 5 cm, high litter cover (81.5%), tall vegetation (56.9 cm), and high vertical density of vegetation
Hergenrader 1962	Nebraska	Idle, idle tame	Nested in smooth brome
Herkert 1991*a*	Illinois	Burned seeded-native, burned tallgrass, cropland, idle seeded-native, idle tallgrass, idle tame, tame hayland	Were most abundant on large and small prairie fragments in the first growing season following burning (1-4 months), and were absent from hayed areas; minimum encounter area was <10 ha; density was significantly and positively associated to live-plant (mostly grass) richness
Herkert 1991*b*	Illinois	Idle seeded-native, idle tallgrass, idle tame	Were present on areas <10 ha
Herkert 1994*a*	Illinois	Burned seeded-native, burned tallgrass	Were most abundant one (using repeated measures analysis of variance) and two growing seasons (using analysis of covariance) following burning; abundance was significantly and negatively associated with area
Herkert 1994*b*	Illinois	Idle seeded-native, idle tallgrass, idle tame	Presence was not affected by vegetation structure or grassland area
Hughes 1996	Kansas	Cropland, CRP (burned seeded-native, idle seeded-native), hayland, idle tallgrass, tallgrass pasture, wetland, woodland	Vegetation at nest bowl was characterized by higher overall vegetative volume in the canopy and lower amounts of bare ground and litter coverage than either the area immediately adjacent to the nest (within 4 m) or the field in which the nest was located; mean vegetation measurements at nest site were 74.8 cm vertical obstruction reading, 63.1 cm live vegetation height, 53.3 cm dead vegetation height, 82.75% total canopy cover, 61.66% live canopy cover, 21.1% dead canopy cover, 78.93% grass canopy cover, 3.62% forb canopy cover, 0.18% woody canopy cover, 15.93% bare ground cover,

			50.12% litter cover, and 0.54 cm litter depth; nest success was not significantly different between nests located <50 m from a wooded edge and those >50 m from a wooded edge
Hughes et al. 1999	Kansas	CRP (burned seeded-native, idle seeded-native)	Daily nest-survival rate was positively associated with percent litter cover within fields, and was negatively associated with both percent live and dead canopy cover; surrounding land uses and characteristics of field edge did not affect daily nest-survival rate; vertical density of vegetation within fields was positively associated with Dickcissel abundance; amount of wooded area within 800 m of CRP fields and percent wooded field perimeter were negatively associated with Dickcissel abundance; authors believed that the negative effect of wooded variables may have been due to sampling technique
Hull et al. 1996	Kansas	CRP (burned seeded-native, idle seeded-native)	Were common in native CRP, with highest abundances occurring in areas with a high frequency of occurrence of forbs
Jensen 1999	Kansas	Burned tallgrass, burned tallgrass pasture, cropland, tallgrass hayland, tallgrass pasture, woodland edge	Nest sites (0.25 m^2 around the nest) had significantly less bare ground and litter cover, and significantly greater live grass height, live forb cover and height, and live woody vegetation cover than the area 1-10 m around the nests; mean vegetation variables at the nest site were 49% grass cover, 41 cm live grass height, 2% standing dead grass cover, 6 cm standing dead grass height, 27% mean forb cover, 37 cm mean live forb height, 5% live woody cover, 8 cm woody height, 8% bare soil cover, and 9% litter cover; of 124 nests, none were found within 25 m of a wooded edge; mean nest distance from agricultural edges was about 44 m and mean nest

			distance from woodland edges was about 70 m
Kahl et al. 1985	Missouri	Burned tallgrass, cropland, idle, idle tallgrass, tallgrass hayland, tallgrass pasture, woodland, woodland edge	Were found primarily on grassland study areas, but were also found in oldfields; habitat around song perches in grasslands and oldfields had few (<350 woody stems/ha) or no woody stems <2.5 cm diameter at breast height (dbh), no woody stems ≥2.5 cm dbh, and dense ground vegetation (≥85%)
Klute 1994, Klute et al. 1997	Kansas	Burned tallgrass pasture, CRP (burned seeded-native)	Preferred grazed pastures to CRP fields, which was probably because of greater numbers of insect prey in pastures and greater canopy and forb coverage
Laubach 1984	Iowa	Burned tallgrass, idle tallgrass	Used fence posts, small trees, and tall forbs as song perches
McCoy et al. 1999	Missouri	CRP (idle seeded-native, idle tame)	Fecundity over 3 yr within CRP fields was consistently lower than necessary to support a stable population
Meanley 1963	Arkansas	Cropland, idle	Preferred thorny shrubs in roadsides bordering mature oat fields; nested in thorny shrubs, hawthorn (*Crataegus* sp.), common buttonbush (*Cephalanthus occidentalis*), grass, plum (*Prunus* sp.) trees, and dogwood (*Cornus* sp.); higher densities were found along roadside borders than in open fields
Monroe 1967	Michigan	Cropland, idle, tame hayland	Preferred oldfields consisting of alfalfa, bluegrass (*Poa* sp.), yarrow (*Achillea millefolium*), and dog fennel (*Erigeron* sp.); were not found in cropland
Overmire 1962, 1963	Oklahoma	Idle tallgrass, tallgrass pasture	Trees, shrubs, and forbs were present in territories more than expected, and grass less than expected based on availability; nests were built in trees (mostly American elm), shrubs, forbs, and on the ground; ground nests

			were more successful, but nests were built higher as the breeding season progressed
Patterson 1994, Patterson and Best 1996	Iowa	Cropland, CRP (idle tame, tame hayland)	Were most abundant in areas with high forb cover; nest density was correlated positively with vertical vegetation density and total percent canopy cover; average nest-site vegetation measurements were 67 cm vertical cover, 98 cm live vegetation height, 38 cm nest height, 48% grass canopy cover, 54% forb canopy cover, and 94% total canopy cover
Petersen 1978	Kansas	Burned tallgrass, idle, idle tallgrass, wetland	Densities were higher in oldfields than in either annually burned or unburned prairie; densities did not differ between burned and unburned prairie; preferred tall vegetation within oldfields and prairie; in oldfields, height of vegetation in occupied areas was 98.3 cm, compared to 85.9 cm in unoccupied areas
Renken 1983, Renken and Dinsmore 1987	North Dakota	DNC (idle seeded-tame), idle mixed-grass, mixed-grass pasture	Were found only in a dense alfalfa-wheatgrass (*Agropyron*) plot with thicker, deeper litter layer than any other plot; mean vegetation values for used areas were 76.3% grass cover, 27.1% forb cover, 100% litter cover, 0.3% shrub cover, 0% bare ground, 20 cm effective height, and 4.7 cm litter depth
Robel et al. 1998	Kansas	CRP (burned seeded-native, idle seeded-native)	Abundance and nest success were higher on unburned than spring-burned CRP; nest success was higher 1yr and 3-4 yr postburn than 2 yr postburn
Rotenberry and Wiens 1980	Colorado, Kansas, Montana, Nebraska, Oklahoma, Oregon,	Idle mixed-grass, idle shortgrass, idle shrubsteppe, idle tallgrass, montane	Abundance was correlated positively with percent grass cover, percent litter cover, total vegetation contacts, maximum vegetation height, effective vegetation height, and vertical litter depth; abundance was correlated

	South Dakota, Texas, Washington, Wisconsin, Wyoming	meadow	negatively with percent bare ground, coefficient of variation for total height and height difference, and horizontal litter depth
Roth 1980	Texas	Idle tallgrass	Preferred dense herbaceous cover; percent cover for heights of 0.15 m, 0.30 m, 0.60 m, and 0.90 m ranged from 11 to 99% on occupied sites; preferred less shrub cover (volume of shrubs on occupied and unoccupied sites were 9.6 m^3 and 15.0 m^3, respectively); nests were located 0.15-0.25 m from the ground and were associated with small woody plants surrounded by dense grass or 0.6-0.9 m tall forbs
Sauer 1953	Missouri	Idle, pasture, tame hayland	Were found in pasture and unmowed alfalfa fields; nested in currant (*Ribes* sp.) bushes
Skinner 1974, 1975	Missouri	Idle tallgrass, idle tame, tallgrass hayland, tallgrass pasture, tame hayland, tame pasture	Lower abundances were found in areas where forbs predominated or were extremely scarce, but higher abundances were found in idle or grazed fields with scattered forbs
Skinner et al. 1984	Missouri	Burned tallgrass, idle tallgrass, tallgrass hayland, tallgrass pasture, tame pasture	Were found in medium to tall grasslands with many tall forbs (35% cover at 1 cm, 45% at 25 cm, 10% at 50 cm), conditions usually found in moderately grazed to idle cover; nested in individual forbs, and occasionally above ground in clumps of grass
Steigman 1993	Texas	Tallgrass hayland	Commonly nested in green milkweed (*Asclepias viridiflora*), sensitive briar (*Schrankia roemeriana*), and eastern gammagrass (*Tripsacum dactyloides*)
Stewart 1975	North Dakota	Idle, idle mixed-grass, idle tame, tame hayland	Were common in hayfields, particularly alfalfa; used oldfields, and dense, ungrazed prairie with a mix of

			forbs, grasses, and shrubs
Swengel 1996	Missouri	Burned tallgrass, burned tallgrass hayland, tallgrass hayland, tallgrass hayland/pasture	Were more common in hayed areas than burned areas and in mesic than dry prairie; lower abundances were found on grazed/hayed areas than on hayed or burned/hayed areas
Taber 1947	Wisconsin	Cropland, idle, tame hayland, wetland	Commonly nested in clover (*Trifolium* sp.) hayfields; nested in wetlands, shrubs, and oldfields; nested on the ground or up to 0.3 m high
Von Steen 1965	Nebraska	Cropland, idle, tame hayland	Commonly nested in rose (*Rosa* sp.) and alfalfa; mean nest height was 0.34 m
Warner 1994	Illinois	Cropland, idle, pasture	Nested in wider tracts of strip cover, such as waterways (7-28 m wide) as opposed to fencerows (1-3 m wide)
Wiens 1973	Colorado, Montana, New Mexico, Oklahoma, South Dakota, Texas	Idle mixed-grass, idle shortgrass, mixed-grass pasture, semidesert shrubsteppe pasture, shortgrass pasture, tallgrass pasture	Were found in areas with tall, dense vegetation, high vertical vegetation density, and high forb density; mean habitat values for occupied sites in grazed areas were 100% grass cover, 25% forb, 0% woody, bare ground, and rock; 701 forb stems/m^2; 29% open sky at ground level; litter layer was 1.60 cm deep with 74% cover; emergent vegetation height was 21 cm; effective vegetation height was 13.5 cm
Winter 1998, 1999	Missouri	Burned tallgrass, idle tallgrass, tallgrass hayland	Nested in forbs (45%) (mostly lead plant [*Amorpha canescens*] and ashy sunflower [*Helianthus mollis*]), shrubs (29%), grass (16%), and litter (10%) at a height of 17 to 19 cm above the ground; mean vegetation measurements at successful nest sites were 2 cm litter depth, 49 cm vegetation height, 30 cm vertical obstruction, 2.7 woody stems/m^2, 11% litter cover, 56% grass cover, 26% forb cover, 4% woody cover, and 4%

			bare soil; nest success increased with vegetation height and density
Zimmerman 1966	Kansas	Idle	Commonly nested in forbs; males had ≥50% forb cover in their territories
Zimmerman 1971	Kansas	Idle, idle tallgrass, pasture, woodland	Selected oldfields with high forb coverage; selected nesting sites with tall (50-150 cm) and dense vegetation
Zimmerman 1982	Kansas	Idle, idle tallgrass	Nested in oldfields and tallgrass prairie
Zimmerman 1993	Kansas	Burned tallgrass, idle tallgrass	Frequencies of relative abundance in annually burned and unburned grassland were similar; factors affecting nest site selection included vegetation height and density; males with territories having abundant forbs and grasses attracted more females than males with less forbs and grasses in their territory

*In an effort to standardize terminology among studies, various descriptors were used to denote the management or type of habitat. "Idle" used as a modifier (e.g., idle tallgrass) denotes undisturbed or unmanaged (e.g., not burned, mowed, or grazed) areas. "Idle" by itself denotes unmanaged areas in which the plant species were not mentioned. Examples of "idle" habitats include weedy or fallow areas (e.g., oldfields), fencerows, grassed waterways, terraces, ditches, and road rights-of-way. "Tame" denotes introduced plant species (e.g., smooth brome [*Bromus inermis*]) that are not native to North American prairies. "Hayland" refers to any habitat that was mowed, regardless of whether the resulting cut vegetation was removed. "Burned" includes habitats that were burned intentionally or accidentally or those burned by natural forces (e.g., lightning). In situations where there are two or more descriptors (e.g., idle tame hayland), the first descriptor modifies the following descriptors. For example, idle tame hayland is habitat that is usually mowed annually but happened to be undisturbed during the year of the study.

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